

## Geotechnics III

Code: MK3GTH3S6SX17-EN

ECTS Credit Points: 6

Evaluation: exam grade

Year, Semester: 3<sup>rd</sup> year, 6<sup>th</sup> semester

Its prerequisite(s): Geotechnics II.

Further courses are built on it: Yes

Number of teaching hours/week (lecture + practice): 4+2

### Topics:

Construction of earth works (design, building and monitoring). Geosynthetics.

Foundation Types. Design of rigid and flexible shallow foundations (spread, pier, slab, box foundation). Determination the bearing capacity and settlements of soils under load. Factors effecting the value of differential settlements. Stability analysis. Types and design of different support systems of Excavations. Bearing capacity of pile foundations. Anchorages. Design of ground Anchors. Design and construction of cast in situ and prefabricated diaphragm walls. Dewatering.

History of deep foundation. Load bearing capacity of foundations. Effect of the surrounding soil/rock. Load transmitting systems. Piling techniques, examples. Designing of piles and pile groups. Building and designing of diaphragm walls. Diaphragm wall boxes. Design aspects of underground garages. Underpasses. Pipe bursting. Lining materials and techniques of underground structures. Soil improvements.

### Literature:

*Recommended:*

- Chang-Yu Ou: Deep Excavations. Taylor and Francis, London, 2006.
- Dandy, G., Walker, D., Daniell, T., Warner, R.: Planning of Engineering Systems. Taylor and Francis, London, 2006.
- Fang, H. S.: Foundation Handbook. Chapman and Hall, New York, 1990.
- Fang, Hsai, Yand, Daniels, J. B: Introductory Geotechnical Engineering. Taylor and Francis, London, 2006.
- Lancelotta, R.: Geotechnical EGINEERING. Balkema. Rotterdam, Brookfield, 1995.
- Mitchell, J. K. Fundamentals of soil behaviour, John Wiley and Sons, New York, 1976.
- Moseley, M. P., Kirsch, K. ed. Ground Improvement. Taylor and Francis, London, 2004.
- Tomlinson, M. J.: Foundation design and construction.n. Pearson Education, Harlow,2001.
- Atkinson, J.: The Mechanics of Soils and Foundations (Second edition), Taylor and Francis, London and New York, 2007
- Powrie, W.: Soil Mechanics Concepts and Applications (Third edition) CPR Press, Boca Raton, London, New York, 2014
- Das, B.M. (2006) Principles of Geotechnical Engineering, 7th or 8th Editions, Thomson Publishing (limited chapters)
- Duncan, J.M . and Wright, S.G., Soil Strength and Slope Stability, 2005 Wiley

### Schedule

1<sup>st</sup> week Registration week

**2<sup>nd</sup> week:**

**Lecture:** Geosynthetics. Design of gesyntetic filters.

**Practice:** Syllabus, polices, introduction.

**4<sup>th</sup> week:**

**Lecture:** Bearing capacity enhancement factors to account for shape, depth and weight. Bearing capacity of homogeneous and layered soils. The effect the water table. Shallow foundations subject to horizontal and moment loads.

**Practice:** Shallow foundation HWA (I/2)

**6<sup>th</sup> week:**

**Lecture:** Idealized elastic soil behavior. Stress distribution under the foundation. Consolidation theories. Settlement analysis of shallow foundations on clay and sand.

**Practice:** Shallow foundation HWA (I/4)

**8<sup>th</sup> week: 1<sup>st</sup> drawing week****9<sup>th</sup> week:**

**Lecture:** Fundamentals of Deep Foundations. Pile Foundations. Pile types. Pile driving and allowable stresses. Construction, inspection, specifications and case histories.

**Practice:** Settlement estimation HWA (II/2)

**11<sup>th</sup> week:**

**Lecture:** Soil-Structure Interaction for Deep Foundations. Axial loading of deep foundations. Base resistance of a single pile. Lateral Loading of deep foundations. Load testing of deep foundations. Static analyses of piles and drilled shafts in clays and in sand. Time dependency of capacities. Field Load Testing of Foundations.

**Practice:** Piled foundation HWA (III/1)

**13<sup>th</sup> week:**

**Lecture:** Case studies of failed foundations. Fracture and settlement analyses of the case studes.

**Practice:** Piled foundation HWA (III/3)

**15<sup>th</sup> week: 2<sup>nd</sup> drawing week****3<sup>rd</sup> week:**

**Lecture:** Types of foundations. Shallow strip foundations (footings). Concept of upper and lower bound solutions. Simple lower bound (safe) and upper bound (unsafe) solutions. Undrained analyses (simple circular arc, theories of Prandl and Reissner). Drained analyses (Terzaghi's theory)

**Practice:** Shallow foundation HWA (I/1)

**5<sup>th</sup> week:**

**Lecture:** Soil structure interaction principles. Contact pressure distribution. Factors influencing contact pressure distribution beneath rigid and flexible footings. Concentrically and eccentrically loaded cases.

**Practice:** Shallow foundation HWA (I/3)

**7<sup>th</sup> week:**

**Lecture:** Balancing bearing capacity and settlement in design. Allowable total and differential settlement of structures. Raft foundations. Heave and settlement of foundations due to changes of groundwater.

Midterm test.

**Practice:** Settlement estimation HWA (II/1)

**10<sup>th</sup> week:**

**Lecture:** Structural issues and design. Drilled Shaft Foundations. Other types of foundations (micropiles, helical anchors, anchors, soil nails etc.) Static Capacity Design of Deep Foundations.

**Practice:** Settlement estimation HWA (II/3)

**12<sup>th</sup> week:**

**Lecture:** Pile testing and driving formulas. Wave equation analyses. Capacity of pile groups. Special foundations. Foundation design in relation to ground movements. Foundation on recent refuse fills.

Design of Foundation for seismic forces.

Special problems with foundations on swelling soils.

**Practice:** Piled foundation HWA (III/2)

**14<sup>th</sup> week:**

**Lecture:** Preparation/instructions for the test and for the verbal exam. End of Semester test.

**Practice:** Consultation with the assigned design projects.

**Requirements**

**A, for a signature:**

Attendance: Participation at lectures is critical to successful completion of this course. Participation is compulsory at the laboratory/problem solving classes. More than 3 unexcused absences result incompletion of the course. There are no make up labs with another group. Tests and oral exam questions will be covered in lectures. Making lecture notes is critical to complete the course.

**B, for a grade:**

Completion of the course: Submitting the laboratory reports and the homework assignments. Participating at least 70% at laboratory/problem solving. D or higher grades for both tests. There is one make up test for each. Grading of tests:

Score	Grade
0-60	(F) fail (1)
61-70	(D) pass (2)
71-80	(C) satisfactory (3)
81-90	(B) good (4)
91-100	(A) excellent (5)

Grading of the course:

Mid term Test 12%

End of semester Test 12%

Shallow foundation HWA 14%

Settlement estimation HWA 12%

Piled foundation HWA 10%

Final (verbal exam) 40%

An oral exam is taken at the end of the semester in the exam period. Students have to sign up for the scheduled exam in the Neptun System minimum two days in advance.